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Report of Professor A. K. Eaton, Upon Analyses of the Passaic and Hackensack Waters.

To the North Hudson County Water Commissioners; W. W. Shippen, President.

Gentlemen: Some six weeks since I received from Mr. L. B. Ward one gallon of water in a sealed bottle, marked "A. September 16th, 1873," and a few days subsequently another bottle marked "B, September 13th, 1873," with a request to make a complete chemical analysis of each with reference to the determination of their relative purity as potable waters.

As usual, I made first a preliminary examination with reference to the following points, clearness, color, smell, hardness, etc.

"Clearness."—This property is dependent upon the suspended matters present, and is determined by simple inspection, a flask of the unsettled water being held in front of a dark background and illuminated by a strong light. The water marked "A" exhibited considerable suspended matter as compared with "B," evidently nearly twice as much as was exhibited by the latter.

"Color."—The color of the settled waters from each bottle differed also considerably; taking the usual scale of comparison, in which 0 represents distilled water and 12 quite turbid water, the amount of color would be represented as follows. I used the Ridgewood water, as it runs from the pipes in my laboratory, as a means of comparison also:

	Color.
Distilled water	0
Water marked "A"	4
" " "B"	2
Ridgewood	1

The color in both cases seemed to arise from some vegetable extractive matter, and though there is a difference of opinion as to the wholesomeness of waters thus affected, it is needless to say that the less there is of this coloring-matter, the better.

"Smell."—The water marked "A" has a noticeable peaty odor, of the same origin, doubtless, as the color. I could not recognize any odor in the water marked "B."

"Hardness."—The hardness of potable water is a matter of some moment, since it affects materially its application to domestic use. All waters decompose more or less soap before a permanent lather is formed. The *amount* of soap thus decomposed is a very delicate and accurate test of the relative hardness of any water. What is known as "Clark's Soap Test," is, therefore, generally depended upon in determining the degree of hardness.

The following are the results upon these waters, to which are added others for comparison:

	Hardness.
Water marked "A"	3
" " "B"	3¼
Ridgewood	1½
Thames, above London	6½

The degree of hardness of the two waters is not so great as to render them objectionable. From these preliminary examinations I infer the relative superiority of the water marked "B."

"Ammonia."—The determination of the amount of ammonia already formed, and the possible amount that will be produced by the decomposition of the putrefiable organic matter present, is, at the present time, considered the most important point in establishing the character of potable waters in a sanitary point of view. The ammonia-producing compounds, are for convenience termed albumenoi ls, and their presence in any considerable quantity is sufficient to condemn any water so far as the use of it for drinking is concerned. Recent investigations have resulted in methods for determining with the greatest precision not only the amount of free ammonia, but also the exact amount that may be eventually generated by the decomposition of the organic matter present.

The following are the results of the determination of the free and albnmenoid ammonia present in these waters, in grains, per U. S. gallon:

	Ammonia. Free.	Ammonia Albumenoid.
Water marked "A"	.0118	.0396 grs.
" " "B"	.0014	.0186 "

Tne water marked "B" contains so little that it cannot be considered objectionable. The water marked "A" approaches so nearly to the limit beyond which waters are considered decidedly unwholesome, that it suggests possible sewage contamination. It is considered that the amount of "albumenoid ammonia" should not exceed .0460 grs. per gallon. The water in question is within the limits of safety, but relatively to the other is greatly inferior.

[Having learned since commencing these analyses that the water marked "A" is from the Passaic river, and that marked "B" from the Hackensack, I shall, in the succeeding tables, use their proper designations.] The determination of the nitric acid present in potable waters is another point of importance, since it frequently, though not always, results from decomposition of nitrogenous matter present. These waters gave the following amounts of nitric acid:

Passaic	.1892 grs.
Hackensack	.0912 "

Here we have results showing much in favor of the Hackensack water, though the quantity in the Passaic is not sufficient to condemn it.

By evaporating the waters to dryness and completing the dessication at 266° Fahr. I obtained the "total solid residues," which, after being ignited, gave me the "ashes," or "inorganic matter" of the waters, the difference of weights, before and after incineration, giving the "organic matter." I used the unsettled waters, which will account for the fact that the results from the Passaic are greater than those given in some former analyses of that water, in which the *settled* waters were taken:

	Total Solid Residues.	Inorganic Matters.	Volatile and Organic Matter.
Passaic water	7.8742	6.3677	1.5163
Hackensack	6.4460	5.1911	1.2249

It seems to be generally admitted that a large amount of solid matter in drinking water is not prejudicial, so long as the organic matter is not of a seriously objectionable character. Many potable waters that are used with impunity carry much more solid impurity than any in the above table.

The following is a full analysis of the ashes of the two waters, in grains, per U. S. gallon:

	Passaic.	Hackensack.
Silica	1.5750	1.1365
Lime	1.3633	1.5052
Sulphuric Acid	.8148	.8019
Chlorine	.3524	.2909
Phosphoric Acid	.3996	.2840
Magnesia	.3732	3954
Potash	.2124	.0960
Soda	.4176	.2009
Peroxide of Iron	.0998	.0246
Alumina	.1940	.0123
Carbonic Acid and loss	.5546	.5034
Total ashes—grains	6.3577	5.1911

These mineral constituents are of secondary importance. They, however, sometimes suggest the origin of other impurities, and cannot be wholly ignored.

The results of the analyses, throughout, are in favor of the water from the Hackensack, though not condemnatory of the Passaic. The question arising as to the possible presence of copper in the water, from the vicinity of the Schuyler copper mine, I subjected the water to careful analysis, but found no copper present.

Very respectfully yours, etc.,

A. K. EATON, Chemist.

BROOKLYN, November 12th, 1873.

Luminous Apparitions or False Lights.—These are not due, as was long supposed, to the products of animal or vegetable decomposition, but are caused by insects which possess organs that become luminous at the time of their sexual congress. It is now well known that the phosphorescence of the sea is due to the presence of immense numbers of microscopic animals.—*Journal of the Chemical Society.*

Chemical Repertory.

No. 120.—October 16, 1874.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

1253. California Petroleum.—The tunnel through which the Southern Pacific Road will pass out of and into San Fernando valley, Los Angeles county, will be nearly a mile in length, and will run through a range of hills out of which rock oil is constantly oozing. Experienced oil miners are confident that the tunnel will tap so many small veins of oil that a considerable quantity of crude petroleum will run steadily from its mouth.

1254. Putrefaction.—M. Paul Bert.—Meat does not oxidise or putrefy in compressed air, though it undergoes changes of color, texture and flavor. Certain fermentations may be arrested by oxygen at a high pressure. Wines may be prevented from undergoing the acetous fermentation by the action of compressed air.—*Les Mondes.*

1255. Rhymes for the Times.—

We lit the poor fellow at dead of night,
The carcass continually turning,
In order that each side might get its due share
Of this new patent process of burning.

Few and short were the prayers we said,
And we spoke not a word of sorrow,
But merely remarked "Don't he sizzle! he'll be
But a handful of ashes to morrow."

1256. A New American Barometer.—At the August meeting of the American Association at Hartford, a paper was read by Professor B. S. Hedrick, describing "An Improvement on Descarts's Barometer;" referring to an instrument containing mercury and heavy petroleum, which boils at about 300°, the tube being enlarged above the position of the mercury, so that the light liquid on top exhibits all changes very readily and they are plainly visible even at some distance.

1257. Bubbles.—Marangoni and Stefanelli.—With an atmosphere of thin vapor of the sulphide of carbon the authors succeeded in obtaining two bubbles of 60 centimetres (23·5 inches) diameter, probably the largest that have ever been seen. A curious effect observed is, that a bubble does not vibrate by any sound however violent, transmitted from without, whereas it readily vibrates when the motion comes from the interior air. The phenomena of rupture of bubbles, the deformations of connected bubbles, and various other points are treated.

1257. Success for Prideaux.—The Lords of the Admiralty have ordered Mr. Prideaux to fit his apparatus for economising fuel, preventing smoke, and reducing the temperature of the stokehole, on board her Majesty's ship *Audacious*, armor plated, 6,034 tons, 4,027 horse power, now being fitted at Chatham dock yard as the flagship for the China station. The Swedish Government also have ordered their gunboat *Scenskound* to be fitted with the apparatus.

1259. Fuel-Blocks.—Mr. D. Barker's "improvements in the manufacture of artificial fuel," are for the purpose of utilising coal, anthracite, lignite, etc., when in a state of powder, and rendering them suitable for smelting iron, or other purposes requiring a very high temperature. If the coke is the article of manufacture, it is first powdered, mixed with mucilage, and pressed into blocks. If anthracite is employed it is first coked, and then treated as the foregoing. The mucilage is made by mixing one part of farina, from which the gluten has been removed, with twenty parts of water, and adding thereto a solution of sulphate of alumina in water.

1260. What a Country.—Corn for fuel we have heard of for some time. The *Scientific American* now tells us that the hay in some parts of Iowa is so very abundant and cheap that it has been found more economical as a fuel for steam purposes than peat or any other substance. One enterprising inventor writes to it to know if he can obtain a patent for the idea of using hay for fuel in steam boilers. He thinks it new in the annals of steam engineering to use hay for firing.

1261. Bad Air in Wells.—Recently ignited charcoal absorbs about thirty-five tifties its volume of carbonic acid gas in twenty-four hours. A pan of glowing charcoal, therefore, lowered into a well or cellar containing carbonic acid soon ceases to glow and begins immediately to absorb the gas. By testing the air from time to time by lowering a lighted taper into it, and renewing the coal from hour to hour as long as necessary, all the carbonic acid may be rapicly removed.—*Iron.*

1262. Coal in France.—In France coal remains at late prices, and little fear is entertained that they will rise before the winter. In Belgium there is on the contrary a decided tendency towards improved rates; at Mons, in fact, a rise of one franc in manufacturing, and two francs in domestic coal has been announced. Still, orders are flowing in, and at Charleroi there are complaints of want of more hands, while the stocks are running out. One cause of this state of things is that the first winter orders are given rather earlier in Belgium than in France. The fact that the Coal Association of Charleroi has authorized holders of stocks of more than 8,000 tons to lower their price for home as well as export trade, to the end of the year, proves pretty clearly that there is no real rise and no exhaustion of stocks.—*Iron.*

1263. New York Street Lamps.—From a recent of the Department of Pu lic Works, we get the following:

Gas is furnished to the city by the following companies, which divide annually between them a portion of the $700,000 appropriated for lamps and gas,

Company.	Number of lamps.
New York Gas Light Company	3,011
Manhattan Company	6,542
Metropolitan Company	3,425
Harlem Company	4,055
New York Mutual Oompany	586
Westchester Company	1,502
Suburban Company	901
Total number of lamps	20,022

1264. Carbolic Acid and Cadavers.—M. Prat.—Four bodies were placed in sawdust saturated with carbolic acid, exposed to the air in this state for two months, and were then buried. They were afterwards exhumed, the one after the lapse of two years, and the three others after five years. The author found on examination that the acid had greatly modified the course of putrefaction. Decomposition remained stationary as long as the carbolic acid was able to act, but when it disappeared, by evaporation or other causes, the putrefaction resumed its course with much greater rapidity, and the bodies were converted into adipocire.

1265. Pennsylvania Gas-Wells.—Encouraged by their success in the use of natural gas for fuel at their works at Leechburg, Messrs. Roger & Burchfield are boring for gas at their works at Apollo. The drill is now down six hundred feet, and a few days ago they struck a very strong vein of salt water; petroleum was also met with, and gas in such quantities as to burn to the height of several feet.

1266. Health of London.—At a recent meeting of the Guardians of the City of London Union one of the medical officers called attention to the high death rate prevailing in the city, "and expressed no surprise, as he stated that he hrd been expecting it for some time. The foul, close smells, intensified by the late sultry weather, would, in his opinion, bring about some epidemic fever or, more probably, a severe attack of cholera." Another member said the ward of Billingsgate was in a most foul condition, and it was finally resolved to communicate with the City Sewer Commissioners.

[The death-rate here complained of is stated to be far smaller than that of New York City.]

1267. British Gas Patent.—W. W. Box, Crayford gas works, Kent.—Improvements in apparatus used in the manufacture of gas.—These are to render unnecessary the use of liquid in the hydraulic main, and consist in constructing the cap at the top of the dip-pipe with a stuffing box, through which passes a spindle, which is attached at one end to a lever supported on a fulcrum, and provided with a counterbalance weight, while the other end is extended to any convenient length, and is operated upon by a chain or rod. The other extremity of the spindle is fastened to a hollow conical valve made with a flange at its base. The bottom of the dip pipe is a V shaped edge. The cone and dip pipe are thus made into a valve, which may be opened by pulling down the rod, and closed by the counterpoise when the rod or chain is released.

1268. Iron Ore under New York.—We knew that our city was founded on a rock, but not, as the *Iron Age* now tells us, that the iron ores of Westchester extended under us. That Journal says that a few weeks since, Mr. J. W. Bennett, a Custom House employe, saw a number of laborers engaged in digging a foundation on the northwest corner of Washington and North Moore streets, three blocks from the public stores. As Mr. Bennett is an old miner, having been engaged in mining enterprises, principally connected with the iron interest, for more than thirty years of his life, he was attracted by the appearance and the color of the substance that was being carted away from the excavation. Upon a close examination he discovered that the laborers had struck a rich vein of hematite ore, worth, at least, six or seven dollars per ton. The vein, which is thirty feet wide, was found at a depth of four feet from the surface. Its depth is as yet unknown, for when Mr. Bennett saw it the workmen had only penetrated to the depth of three feet.

1269. Prices of Metals.—The following interesting figures we copy from the *Scientific Press*, of San Francisco:

The first 8 metals of the table are extremely rare, and are only sold in minute quantities, but at rates which would make the value of a pound as stated. It will be seen that the expression, "worth its weight in gold," is by no means superlative.

VALUE PER POUND AVOIRDUPOIS.

Indium	$2,520 00	Silver	$18 85
Vanadium	2,520 00	Cobalt	7 75
Ruthenium	1,400 00	Cadmium	6 00
Rhodium	700 00	Bismuth	3 63
Palladium	653 00	Sodium	3 20
Uranium	576 58	Nickel	2 50
Osmium	325 28	Mercury	1 35
Iridium	317 44	Antimony	36
Gold	301 45	Tin	33
Platinum	115 20	Copper	25
Thallium	108 77	Arsenic	15
Chromium	58 00	Zinc	11
Magnesium	46 50	Lead	07
Potassium	23 00	Iron	0.021

1270. Mechanical Vibration and Rust.—Prof. Haldeman.—When railway bars are piled beside a road they soon become rusted, while those forming the track are but little subject to oxidation: and when a rain of some hours' duration falls upon rails when in a state of rest, as upon Sundays, when trains do not run, they soon exhibit rust. This would seem to indicate that in chemical combination mechanical vibra-

tions may interfere with the molecular arrangement of the elements. The accuracy of these casual observations should, however, be submitted to the test of experiment.

In the discussion which followed this brief communication it was suggested that possibly the oil employed upon locomotives might be more or less spread in a thin film over rails in use, and thus prevent their oxidation. This view was earnestly combatted by other speakers. Prof. Van der Weyde was quite certain that the suggestion of Prof. Haldeman bore reference to a fact in physics. Molecular vibrations tended to prevent rust. A saw hung up, unused, would soon become rusty; if used, would keep bright. This was a general experience with tools.—*American Association at Hartford.*

Petroleum in the Caucasus.

Another whiff of petroleum vapor comes to us from these far away oil fields, in the form of an extract from a letter published by an East India paper. We do not fear much competition from this direction so long as we continue to quote our crude oil in the neighborhood of a dollar a barrel at the wells, but with American petroleum at five or six dollars a barrel, it would not be strange to see a formidable rival springing up on the banks of the Caspian.

The letter says: "The inexhaustible petroleum deposits at Baku, on the Caspian, are at last being worked in earnest, the Thickadar, an Armenian, who had a royalty over all the petroleum in the Caucasus, and of course did nothing, having been persuaded or compelled to come to terms. Millions of gallons are consequently now being extracted from these vast reservoirs of buried fuel, which have only to be pierced for the oil to shoot up, sometimes thirty or forty feet above ground. Boring machinery is being procured from Europe or constructed in Tiflis, and is in great demand. The supply is stated to be boundless. Other springs are known to exist; it is probable, in fact, that oil may be 'struck' anywhere along the Caspian. The price of kerosene has already fallen 50 per cent. Yet such is the want of internal communication existing throughout the empire, in spite of the natural advantages it possesses in the way of water communication, unsurpassed except in America, that American kerosene is actually cheaper in St. Petersburg than Russian."

Anthracene.

Concerning this now so valuable constituent of coal-tar, formerly called *paranaphthalene*, Dr. Versmann delivered a voluminous lecture on March 20th, to the London Society of Arts, from which we cull such passages as will most interest our readers:

In tracing the history of anthracene, we find that the two great French chemists, Dumas and Laurent, in 1832, first obtained it from the last fractions of the distillation of coal tar; they exposed the oily matter to extreme cold, when a crystalline deposit separated, which was pressed and washed with alcohol; the residue was further purified by re-distillation, crystallization, and sublimation, and was then submitted to chemical investigation. Dumas and Laurent assigned to the compound thus obtained the formula $C_{30}H_{12}$, and as this is half as much again as naphthalene $C_{20}H_8$, they named the new substance paranaphthalene. But this chemical composition and the low melting point, which was found to be 180° C, convincingly prove that the substance must have been a mixture of several hydro-carbons, and not a definite chemical compound.

Laurent afterwards submitted the substance to fresh investigations, and obtained several interesting derivatives, but as Prof. Kopp suggests, in his exhaustive historical memoir on "Anthracene and its Derivatives," published in the *Moniteur Scientifique*, Laurent evidently had at his disposal only small quantities of the impure hydro-carbon: he therefore could not determine the true composition of the substance, which he now named anthracene.

Fritzsche described, in 1857, a hydro-carbon, obtained from coal tar, which he found in many respects closely to resemble Laurent's anthracene, but which had a melting point of 210° C. to 212° C., and the formula of which he found to be $C_{28}H_{10}$.

Anderson published, in 1862, a most searching investigation of the higher hydro-carbons from coal tar; he separated anthracene in great purity, obtained many of its most important derivatives, prominent amongst which stands his oxanthracene, or anthrachinone, which, however, had already been obtained by Laurent. Anderson retained Laurent's name of anthracene, but confirmed Fritzsche's formula and melting point.

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Anthracene having become of such great commercial importance, its most exhaustive scientific examination became a matter of course: and the last few years have brought us, especially from Germany, a number of most valuable investigations on nearly all the solid hydro-carbons. Berthelot had previously separated and described many of them, but perhaps he had not sufficiently large or sufficiently pure quantities to work upon; at all events more recent publications, the results chiefly of Graebe's and Liebermann's researches, have somewhat modified several of Berthelot's conclusions. In the following table I have given a list of these solid hydro-carbons, their formulas, melting point, and boiling point, as far as they are known at present:

Solid Hydro-carbons.

Name.	Formula	Melting point	Boiling point
		degrees C.	deg. C.
Naphthalene	$C_{20}H_8$	79	220
Acenaphthene	$C_{12}H_{10}$	100	285
Fluorene		113	305
Phenanthrene	$C_{28}H_{10}$	110	340
Anthracene	$C_{28}H_{10}$	213	360
Pyrene	$C_{32}H_{10}$	180	....
Chrysene	$C_{36}H_{12}$	248	360
Retene	$C_{36}H_{12}$	95	400
Benzerythrene			....

Variable quantities of all these compounds are found in commercial anthracene, and their complete separation becomes extremely difficult.

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The attempt to give a separate and distinct account of the characteristics of these solid hydro-carbons would be useless for practical purposes, because, with the exception of the first and last, they are extremely similar to one another, and a quantitative separation becomes a matter of great difficulty. The difference in the action of alcohol, ether, bisulphide of carbon, benzole, petroleum, and other solvents is merely a matter of degree. Nitric acid and sulphuric acid, chlorine, and bromine, produce similar compounds of addition or substitution. A solution of picric acid, mixed with a solution of the hydro-carbons, forms a series of compounds varying in color from yellow and light orange, to dark blood-red, but which are so little stable that even an excess of the solvent, alcohol, separates the acid again. Even similar products of oxidation are obtained from most of them, at least as far as they have been studied. Naphthaline may pretty easily be separated; all solvents take it up most freely: the low melting and boiling point is very marked; even water vapor carries it off, and it may thus be purified. It is formed during the manufacture of gas, and is partly carried off and held in suspension by the gas. With a fall in temperature it often solidifies in the gas pipes, so as almost to choke them up, and thus often becomes a great nuisance to the gas manufacturer, especially as by its abstraction from the gas the illuminating power of the last is sensibly decreased.

Benzerythrene, the last substance on our list, is very little known, and has scarcely yet been studied. It is the very last product in distilling pitch, and may thus be separated without difficulty. It is of a resinous character. After nearly all the oil with the hydro-carbons has passed over, this last product appears in the form of a bright red powdery vapor. It soon loses its fine color on exposure to light, and assumes a dull brown color.

Another substance has been separated from crude anthracene by Graebe and Caro, which they have named *Acridine*, and which is a base containing nitrogen. This is remarkable for its intensely irritating action upon the skin and mucous membrane. The least particle of the dust inhaled produces most violent sneezing. Although it is present only in very minute quantities, it often is the cause of great annoyance to the workmen.

* * * * * * * * * *

None of the natural pitch or bitumen deposits seem to yield anthracene. I have myself tried Val de Travers, Trinidad, and several other of these deposits, without getting any hydro-carbon of this series. We must at present, therefore, look to the coal tar as our only starting point.

The yield of anthracene depends somewhat upon the quality of coal, and certainly also upon the degree of heat to which the coal has been exposed in the gas manufacture. Thus it is generally assumed that Scotch coals yield little anthracene, while South Staffordshire coal is rich in anthracene.

Pure anthracene crystallises in rhomboidal plates, which melt at 213° C, to a clear colorless liquid; it distils at about 360° C. Nearly pure anthracene may be obtained by melting a partially purified sample in a retort, and passing a strong current of air through it, when the anthracene is carried off, and may be collected in the shape of brilliant flakes, or it may also be purified by sublimation.

I have determined the solubility of pure anthracene in alcohol of differing specific gravity, and also in some other solvents, and the result is as follows:

	Per cent. Anthracene at 15° C.	
	By volume	By weight.
Alcohol.....800	.472	.591
" 825	.424	.574
" 830	.408	.491
" 835	.397	.475
" 840	.387	.460
" 850	.360	.423
Ether	.858	1.175
Chloroform	2.587	1.736
Bisulphide of Carbon	1.180	1.478
Glacial Acetic Acid	.472	.444
Benzole	1.470	1.661
Petroleum	.291	.394

* * * * * * * * * *

To England the practical part of the question is of the greatest importance, because England is the great tar-producing country, and the principal supply of anthracene must always come from here. The nine London gas works alone convert about one and a half million tons of coal into gas, and produce about 12,000,000 gallons or 60,000 tons of tar a year. The gas companies have not been slow in profiting by this invention: the price of tar has already been more than doubled, an increase almost sufficient to reduce the price of gas a penny or twopence per 1,000 feet.

Anthracene and Alizarine.—After Graebe and Liebermann's celebrated discovery of the artificial production of alizarine, says the *Athenæum*, and the consequent introduction of dyes obtained from anthracene, the attention of chemists was directed to a number of substitution-derivatives yielded by this hydro-carbon. The nitro-derivatives, however, received but little attention, in consequence of the peculiar behaviour of anthracene under the influence of nitric acid; the reaction producing oxidized products, and not nitro-derivatives. The subject has been recently studied by Herr E. Schmidt, whose results are at variance with those of Phipson, Bolley, and other chemists who had previously worked in this direction. Schmidt has succeeded in preparing pure chrysene—a hydro-carbon obtained in the dry distillation of organic bodies—and has studied its behavior with bromine, chlorine, nitric acid, and other reagents. He obtained chrysene in rhombic tubular crystals, which, though colorless, exhibit an intense reddish-violet fluorescence. Schmidt's "Beitrage zur Kenntniss des Anthracene and Chrysene" will be found in the last part of the *Journal fur Praktische Chemie.*—*Journal Society of Arts.*

French Novelty.—The President of France, on the report of the Minister of Public Works, has issued a decree in favor of the formation of iron tramways, to be worked by steam traction engines, on several public roads, to carry passengers and goods between the station of Reuil, on the St. Germain Railway, and Marley-le-Roi. The *concessionnaire* is M. Eugene Tarbe des Sablons, who undertakes the construction and exploitation of the line entirely at his own risk, and according to a tariff fixed by the government.—*Iron.*

Swedish Stoves.

A correspondent of the Philadelphia *Ledger*, writing from Guttenberg, Sweden, says of the "kakelungs," or stoves, of that country:

In an old note book kept by the writer during tour in North Europe, a year or two since, I chanced upon an entry as follows:

"The amount of fuel consumed warming houses is generally inverse to the amount of cold to be combatted."

The truth of the proposition has been strangely and fully confirmed by a more extended and careful examination into the plans of warming adopted in North Europe, and it is with some fear that the facts may seem incredible that this is written for an American journal. To begin with facts, I will mention that we are now living in two rooms of a hotel, one 20 by 20 feet, the other 20 by 15 feet, the ceiling 12 feet high. Opening into these rooms is one common entrance door and a pair of huge folding doors.

The weather during March was cold, even colder than in Philadelphia or New York, and during this month the number of fires used were about four in a week, each fire consisting of from eight to ten billets of wood twelve inches long, or about enough to start two coal fires in America. The rooms were thoroughly wurmed, and the temperature, night and day, never varied five grades or degrees. The quantity of fuel consumed I will place at one-twentieth part of what would, under similar circumstances, have been required to warm the same rooms in America, and yet we pride ourselves on "what we know about house warming."

I may mention that my son has been here during eight months past, occupying two rooms even larger than those of which the dimensions are given. He purchased last fall one "Fam," about 200 cubic feet of wood, of which on the 1st of March one-fourth was left, after firing all winter. The warming is done with a kind of stove called a "kakelung," and so far as your correspondent can judge, on principles that are more scientific than those of our many patent contrivances, whose double function seems to be to consume fuel and stifle the inmates of our dwellings. This last is I know a strong proposition, but it is based upon personal experience, at the end of three months spent in a first-class dwelling (with modern improvements) in Philadelphia last fall. A sense of relief was felt when we escaped again to old foggy England, where patent heaters are unknown.

The fact is, that the American people are oblivions to the frightful effects that come from their system of heating, and only become aware of its discomforts and dsngers after passing a winter with English grates or the "kakelung." To return to the last named system, a "kakelung" is simply a great stove of masonry, covered with porcelain plates, having usually five flues, through which the gases of combustion must pass up and down, a distance of 30 to 50, or even 60 feet, before escaping into the air. The general principle of their operation is to provide enough material to absorb all the heat from the fire—to conduct the gases through these long flues until their temperature has fallen to a point that no longer gives off heat. The quantity of the material in the "kakelung" is so great that the temperature from one firing (which is always enough) will not raise the temperature of any part so much that the hands cannot be held upon the outside.

Two hours after a fire is made, and after the wood has burned up and the flue been closed, the "kakelung" begins to get warm on the outside, the light porcelain plates give off their moderate warmth to the atmosphere in the room, and ten hours later there will not be much difference in the temperature of the stove or of the room.

A "kakelung" instead of being an unsightly obstruction, is so constructed as to constitute an ornamental piece of furniture. Doors open into them in front, where, in a kind of closet, with iron shelves, food can be kept warm or warmed. Baking can be done in the furnace for hours after the fire has been burned out. In the Grand Hotel Rydberg, at Stockholm, the writer created some merriment by inquiring whether the "kakelungs" were simply erections to support the mirrors and flowers with which they were adorned.

Now this result in heating which has been described, is in a great measure due to double windows. The conducting power of a thin pane of glass interposed between the external air and that of a warm room, is never imagined until an experiment is tried. Such cooling does no good, it simply costs money, and answers no purpose of ventilation, and, speaking from actual experience, I would rather live in a room hermetically sealed and warmed by a "kakelung" than in any room into which burned air is conducted from one of our American furnaces. I am well aware of the scientific arguments and explanations that have been put forth in reference to American house heating. They are good on paper: the practice is what I refer to, and it is without fear of making a mistake, that I assert that any house in Philadelphia can be warmed with one-fourth the amount of fuel, and with twice the comfort, by means of kakelungs, as with furnaces—if other conditions peculiar to heating here, are at the same time observed.

A Jet Aspirator.

By Prof. Robert H. Richards of Boston.

[Proceedings of the American Association at Hartford.]

This paper was entitled a, follows: "An Injector Aspirator for Chemical and Physical Laboratories." It was illustrated by blackboard drawings. During the winter of 1868-69, while assistant in the chemical laboratory of the Massachusetts Institute of Technology, Prof. Richards was called upon to put up Bunsen's filter pump for the chemical laboratories. While studying the best form of the instrument, it was noticed that this aspirator did not utilize in any way the water pressure derived from the hydrant. The instrument here described is the result of an attempt to produce an aspirator which should make use of the hydrant pressure. The principle is somewhat the same as that of the Giffard injector, the jet pump, and the steam syphon. But as all of these instruments derive their power from steam, and have for their object the movement of water, it became necessary to investigate anew, by a set of careful experiments, the best form and conditions when the aspirator instrument was called upon to do the work of an air pump with a water pressure as its source of power. A discussion of the sizes of jets, the various amounts of pressure needed under particular conditions, the form of the cone of enlargement, the angle of this cone, etc., cannot well be understood without having at hand the appropriate diagrams, but the results can be stated in a few words. An aspirator of this form produced its vacuum in a quart vessel in ten minutes (one litre in eleven minutes).

This same aspirator, when pulling against half a vacuum, more properly when sustaining one-half the atmospheric pressure, is able to carry forward a volume of air equal to one-half the volume of water used as its power. The diameter of the jet may vary relatively to the diameter of the apex of the cone into which the water is projected, and the result of this variation is as follows: The smaller the jet the less will be the amount of water required to carry forward a given amount of air, and the less will be the power of the instrument to produce a vacuum: while, on the other hand, the larger the water jet the greater will be the amount of water used, and the greater will be the vacuum-producing power of the aspirator.

But the moment the water-jet becomes larger than the cone apex the instrument is paralyzed and useless. The apparatus which was experimented upon yielded a rarefaction (after making the correction for aqueous vapor) within one and one-half to two millimeters of the Torricellian vacuum within the barometer by its side.

Prof. R. E. Rogers of the University of Pennsylvania, supplemented this paper by a description of a very interesting apparatus which he devised many years ago, and has been useing in connection with a high-pressure steam engine. By means of an aspirator of a peculiar construction, placed between the boiler and the steam-chest, the steam is made to draw, at each stroke of the piston, a volume of air into the engine. By this admixture the power of the engine is materially increased. The ratio of augmentation depends on the relation between the size of the cylinder and the work to be done, showing in a large number of experiments an actual gain ranging from 20 to 30 per cent. over what would be accomplished by the ordinary engine working steam alone.

The explanation of this is to be sought by a reference chiefly to the following facts:

1. Condensation of the steam into water which ordinarily takes place in the cylinder is in a great degree prevented, and thus its efficiency maintained.

2. Whatever steam may be condensed by mixture with the air imparts its latent heat to the air, thereby giving it elastic power. The same is true of the effect of the hot water of condensation.

3. The difference of specific heat of steam and air is such as make the gain of expansive force by the air greater than the loss sustained by the steam.

Natural Gas in the Conemaugh Valley.

During the past ten years the attention of the writer has been frequently called to what is known as gas springs along the line of the Kiskiminetas and Conemaugh River. These springs are found at various points along the aforesaid river from Blairsville to its junction with the Allegheny near Freeport. At some points these springs are so strong as to throw water to a considerable distance above the stream, and produce a seething, rumbling sound, resembling the boiling of a vast cauldron many feet beneath the surface. Many years ago these gas fissures formed the principal barrier to the salt producer in drilling his wells, and many well authenticated instances may be cited where the parties where compelled, on account of the strong flow of gas, which, in some instances, would throw water as high as the tops of the surrounding trees, to abandon half drilled wells and seek other locations for their enterprise. At that time it was thought that these deposits of gas were formed from the immense coal beds which were known to exist in the surrounding hills, but latterly they are supposed to indicate deposits of petroleum many hundred feet beneath the surface; but from whatever source they may come, we are now only interested in the fact that they do exist, and the great question is, can this unceasing stream of self-constituted bicarburetted hydrogen be made subservient to man's uses as a fuel, instead of coal, in the manufacture of the minerals with which the valley of the Conemaugh so richly abounds. Only one test of this has so far been made. We refer to the one at Leechburg. At this place, some years ago, a company was formed for the purpose of testing their territory for oil; a well was drilled to the depth of nine hundred feet, when they struck a reservoir of gas so powerful as to render it impossible to prosecute the work any further. The company abandoned the well, but afterward sold it to Messrs. Burchfield & Rogers, who own a rolling mill at that place. They conveyed the gas in pipes from this well to their works, and are now running their mill entirely with gas instead of coal, at a saving to them of many thousands of dollars a year; and so satisfactory has the enterprise proved that these gentlemen are now engaged in drilling a well at Apollo, with a view to getting gas with which to run their mills at that point.

So far, then, as gas wells are concerned, it has already been demonstrated that, as a matter of fuel alone, they will save to the manufacturer many thousands a year, besides this he gets rid of the dust, dirt, and smoke, which coal, as a fuel, produces. He can also light his works at night with the gas from his well, and it is claimed can produce a much better

quality of iron. The next question is—can this surface gas be so concenirated as to be useful to the manufacturer as fuel? Of this we have not as yet seen any practical tests, that is, we have not seen it gathered into reservoirs, and applied to heating furnaces, driving machinery, etc., but we are satisfied that it only requires a little skill and money to render it fully as useful and efficient as the gas procured by drilling wells.

A few days since, in company with several gentlemen, we visited the farm of Kier, Bros., at Salina, on the West Penn Railroad, four miles west of Saltsburg, on which it was reported one of these springs was located. On arriving we found that one of the workmen on the farm had erected, over the fissure through which the gas escapes, a small clay oven, which formed a sort of reservoir in which the gas could collect. On the top of this oven was a small hole about the size of a straw, through which the gas could escape. On applying a lighted match to this hole we were surprised to see a flame of fire burst forth—strong enough in our opinion to run any ordinary sized manufacturing establishment. We lighted the gas about nine o'clock A. M., left it burning, and returned about three P. M., when we found that instead of the fire having gone out, as some of our party predicted it would, it had increased materially through the influence of the heat, while the rocks in the immediate vicinity were so warm that we could not touch them with our hands. Messrs. Kier Bros., are now erecting a large fire brick works on the farm, and will most assuredly test the value of this spring. Our opinion is that they will get from it gas enough to burn their brick, boil the salt from three wells near by, make steam for their motive power, and have enough left to light a town. The locality abounds in fire clay, limestone, coal and salt.

This is only one of very many farms along the line of this river which offer the advantages spoken of, and our object in writing this letter is to call the attention of our manufacturers to this important fact. This undeveloped source of wealth cannot lie uselessly hidden away much longer. Already the hand of progress grasps the key to unlock this vast treasure house, and ere long we expect to see our beautiful valley lighted up with blazing forges, and hear it resounding with the unceasing clink, clink, of the sledge and hammer. —*Iron Age, from Pittsburgh Commercial.*

National Tube Works Company of Boston and McKeesport.

MANUFACTURERS OF LAP-WELDED WROUGHT-IRON TUBING, PATENT INJECTORS, ETC.

Within the past few years the steadily increasing consumption of steam, water and gas pipe has occasioned a corresponding enlargement of production and induced the establishment of several new and extensive manufactories. Improved processes have been introduced, special machinery has been constructed, and where thirty years ago we were almost exclusively dependent upon England for the above description of merchandize, our own resources are now amply adequate for the production of goods superior in quality to any that are imported, nor is it unreasonable to anticipate, ere many years, a large export demand for our home manufactures in this line.

One of the largest establishments in the country engaged in the manufacture of lap-welded wrought iron tubing of every description, is that of the National Tube Works Company of Boston, Mass.

The premises occupied by the Company at McKeesport comprise six acres of ground, the greater portion of which is covered by the various buildings composing the works, which are completely equipped with furnaces of the most approved construction, machinery of the best possible description, and every conceivable facility for the prosecution of the business upon an extensive scale.

The number of workmen employed at McKeesport when in full operation, is about eight hundred men, and in Boston some four hundred.

American iron is principally used in the construction of tubing, and certain processes employed by no other parties enable this concern to produce goods of a quality that is seldom excelled in this country. The advantage resulting from their mode of manufacture consists in the production of perfectly clean, smooth pipe, even and uniform throughout, characteristics which will be readily appreciated by consumers.

Before leaving the works all tubing, of every description, is thoroughly tested by hydraulic pressure, graduated in accordance with the strain to which the pipe will subsequently be subjected, and nothing is allowed to pass as satisfactory in which the most trifling flaw or slightest indication of weakness is discovered.

A large department of the establishment is devoted to the manufacture of "patent protecting couplings," of wrought iron, so constructed as to work with ease and certainty and by a collar extending over the entire thread on each end of the pipe, it is preserved and re-enforces the joint, making a perfectly tight joint, and proving extremely durable.

The company's works at East Boston are situated upon the border of the Charles river. The premises include about three acres of ground, almost entirely covered with the factory buildings, which, like those at McKeesport, are thoroughly equipped with all the requisite appliances for the manufacture of the various styles of goods which the company produce.

One of the specialties manufactured at this mill is is the National Tube Works Company's "Mack's Patent Injector," designed for feeding water into stationary, marine or locomotive boilers.

Particular attention is also bestowed upon the production of Lap Welded Boiler Tubes, made from the very best quality of American charcoal iron. They are manufactured in all sizes, from an inch and a quarter up to sixteen inches in diameter. The company also make an improved style of tubing and casing for artesian, oil and salt wells.

Although only a comparatively brief period has elapsed since the organization of the National Tube Works Company, they have manifested such a degree of enterprise and energy in the prosecution of the business as to make them already one of the largest and most prosperous concerns of the kind in this country.

Within a year past the company have opened a branch office and warehouse in New York city, at No. 78 William street, corner of Liberty street, where buyers will find a full assortment of steam, gas and water pipes, boiler tubes, injectors, fittings, etc., in all the various sizes. A descriptive catalogue of their different manufactures has been issued by the company, giving drawings of all the principal articles, together with current prices, etc., and can be procured upon application at their various addresses.

Kilkenny Coal—Ireland.—These mines are on the property of George Bryan, Esq., M. P. for the County Kilkenny, and were leased by him to an English company, who at once set to work, employed ample capital, and provided all the newest engineering appliances. They also brought over a few English miners, who, we are happy to say, worked most harmoniously with the resident workmen during the progress of the work towards the discovery; unfortunately, however, in the flush of triumph attending their success, the Englishmen—we believe, without the least idea of giving offence—hoisted a Union Jack over the national flag. This proceeding, perfectly harmless in itself, seems to have been mistaken for a deliberate insult to the "Old Country," by asserting the superiority of England, and the result was that a feeling of indignation was for a time engendered in the minds of thoughtless miners. A very little consideration soon convinced them of the absurdity of their views, and in a few days all unpleasantness was forgotten. The area of the coal field is very extensive, and in the opinion of some of the most experienced mining engineers, calculated to produce a supply for at least 100 years.—*Ironmonger.*

Gems and Generalities.

Economy.—There is a city in Kansas where much time and paper are saved by dating letters "11-worth."

Under "Personal Intelligence" the *New York Herald* has the following: "France sent to England last year 500,000,000 eggs."

[Paying for them must have been quite a *personal* matter to England.[

Great Britain and Ireland collectively consumed nearly 20,000,000 gallons of spirits last year.

In connection with the last item, this is of consideration: The grain crops are reported to be unusually abundant in all foreign countries, except England and Switzerland.

Another spiritual item is as follows: New Jersey has found a method of manufacturing rum from cranberries, which is said to have a longer range than even its famed "lightning," the latter killing at forty rods, while the former is deadly from any'le.

Take Heed.—London was alarmed during the third week of July by the unusually high death rate of 21 per 1000, while New York was at the same time satisfied with a mortality of more than twice as much.

"Bad Cess" to Them.—The Boston Board of Health has reached the wise conclusion that cess-pools *doicent cease* in thickly settled neighborhoods.

Cave Canem.—Cases of death by hydrophobia it is proposed to publish under the head of "Bituary."

American News from Abroad.—*Iron* tells us that "the lighting of street gas lamps by electricity seems to have proved successful in Providence, R. I., the Board of Aldermen having authorized a contract to be made with the inventor for its application to the posts of that city."

Chili wishing to remain Chilli and avoid burning, has decreed that vessels freighted with kerosene shall seek an isolated anchorage and hoist a red flag.

To Ponder.—Many a child goes astray not because there is a want of prayer or virtue at home, but simply because home lacks sunshine.

In many western towns it is asserted that cheap petroleum has converted gas bills into light afflictions.

Our Prejudices.—Oleo margarine is pronounced by its manufacturers as a better kind of butter than any *udder* kind.

[We can't swallow either the opinion or the what d'ye call it. We love the milky mothers of the herd, and on this head we shall never, never yield.]

Ice Cremation.—A Buffalo paper announces that by the recent burning of an ice house there, twenty thousand tons of ice were "reduced to ashes."

Long May It Wave.—It is estimated that before 1880 the volume of our foreign commerce will be fully a thousand millions of dollars greater than it is now.

A new tubular wick petroleum lamp has been contrived by MM. Defienne. It cansists of ten small circular wicks in place of one large one. They are arranged in a circle, and are attached to a frame movable by a single rack.

Injin-uity.—An item is on the rounds that Alaska Indians use for illuminating purposes a curious fish which is so fat that when dried it burns with a brilliant light.

The New York *World* asks if this fish is of the lamprey species? Pity that *gasteropods* are not fishes, a good pun being thus spoiled. These candle fish might very consistently be *dipteri*, or *diplodi*.

Carboniferous Coal in Nevada.

[A communication to the American Institute of Mining Engineers, St. Louis, Moy 27, 1874.

By A. J. Brown, Treasure City, Nevada

I herewith send to the Institute a sample of Pancake coal. It is rather early yet to make any estimate of the future value of the discovery; but it is certainly the most promising ve n of coal yet discovered in the State of Nevada, and, I believe, the first true coal found west of the Rocky Mountains, or perhaps west of the Missouri River, unless some of the Utah coals belong to the coal measures of the Carboniferous age. The Pancake vein certainly belongs to the Carboniferous, as rocks of a later age are wholly wanting in this locality.

The Pancake Mountain is a low range or hills situated in the valley about midway between the White Pine and Diamond ranges, and occupies throughout its length of thirty miles or more the basin or trough of a synclinal fold. The higher mountain ranges, both east and west, follow mainly the axes of mountain anticlinals, and exhibit only Devonian, Silurian, and Azoic rocks. About midway between White Pine and Pancake, two or three mounds which are identical, both lithologically and palæontologically, with the limestone of Treasure Hill crop through the quaternary formation of the valley, and still further west are found dark bituminous shales identical with those found along the east slope of Treasure Hill and under the towns of Hamilton and Eberhardt. Some four miles still further west, and belonging to a much higher geological horizon, we find the coal formation.

The formation immediately inclosing the veins (of which there are said to be two) is mainly slate, though in places a light-colored rock which the miners call soapstone, comes in contact with the vein. Impressions of leaves and plants are found in the slates, and a few specimens of sigillaria have been found on the surface in the vicinity. The sandstone formation, from which is quarried the fireproof lining used in the Eureka furnaces, overlies the coal formation; and I think that another bed of sandstone occurs some distance under it, but of this I am not positive.

The vein, where worked, is situated near the north end of Pancake Mountain, about 14 miles west of Hamilton and 20 miles east of Eureka. The vein strikes north and south and dips steeply (40°) to the west. In thickness it varies from 5 to 6 feet, but it is much broken and displaced; and in some places the coal appears to have been destroyed, and a kind of ash fills its place in the vein. Several experiments at coking on a small scale have been tried, and have resulted satisfactorily. The citizens of Eureka are discussing the feasibility of ligthing their town with gas made from this coal.

Steam hoisting and pumping machinery has been erected on the mine during the past winter, and the company evidently is in earnest in its determination to find coal in paying quantities if it exists.

The mine is opened by two inclines on the vein, the deepest of which is down 240 feet.

A party of prospectors has been engaged during the winter in sinking a shaft in the black shale on the Momomoke Mountain in search of coal. This shale is highly bituminous where protected from the air, and consequently burns for a while with a bright flame, but does not burn to an ash—a fact which has lured numbers of men on to spend several thousand dollars at different times in search for coal where none can be found. Query? do not these two beds of bituminous shales correspond in appearance, characteristics, and geological place with the Marcellus and Genessee shales of New York?

The above description of the appearance of the coal vein, thickness, works, etc., was derived from the owners. I was there early last winter; but the dump was on fire and the works were half full of water, so that I was obliged to return without accomplishing my purpose of seeing for myself. If it is half as good as claimed it is one of the most important discoveries ever made in the State of Nevada.

The New York Water Mains.

AN ABUNDANCE OF WATER—THE NEW MAINS.

As much of the action of the National Board of Underwriters respecting Chicago was based upon that city's defective water supply and system, it may be well to consider how New York is provided in this respect. The following report of the Commissioners of Public Works, furnished by President Oakley of the National Board, answers the inquiry:

The improvement that has been effected in the water supply for extingnishing fires in New York, both by the increase of the number and the size of the mains and pipes, and their more available arrangement, is highly commendable, and presents an example worthy of imitation by other cities. With an abundance of water under a sufficiently high pressure, we possess an antagonist to the mighty and most destructive element, fire, which, under prompt and skilful management, seldom fails to arrest its ravages and give us a speedy victory in the conflict. Before 1861, the principal mains for the water supply of the city were:

Thirty-six-inch main from receiving reservoir to Fifth avenue, down Fifth avenue to Twenty-third st., thence down Broadway to Houston street, thence by a 30-inch main down Broadway to Pearl street, thence down Broadway by a 24-inch main to Fulton street, thence down Broadway by a 20-inch main to Bowling green, thence to South Ferry by a 16-inch main; with 20-inch cross-town connections at Fifty-seventh street, Thirty-eighth street, Twenty-ninth street, Thirteenth street, Houston street, Pearl street, Fulton street and Wall street. Also a 36-inch main from receiving reservoir to Fifth avenue, thence down Fifth avenue and Broadway to Fourteenth street, thence through Fourteenth street to Avenue A, thence through Avenue A and Essex to 20-inch on East Broadway, connecting with the several cross-town 20-inch and 12-inch pipes. Also a 30-inch main from receiving reservoir to Eighth avenue, and down town through Eighth and Ninth avenues, to Thirteenth street; also connecting with the several 20-inch mains. Also a 30-inch main from receiving reservoir to Third avenue, and down Third avenue to Fourteenth street, connecting with the several 20-inch mains.

In 1862 a 48-inch main was laid from the new receiving reservoir to Fourth avenue, thence through Fourth avenue to Forty-second street, thence to distributing reservoir.

In 1873 a 36-inch main was laid from the 48-inch pipe at Forty-second street and Madison avenue, through Madison avenue, Twenty-sixth street, Third avenue, Bleecker street, Mott street, New Bowery, New Chambers street, to Chatham street, thence by a 24-inch pipe, through Chambers street to Hudson st., and a 20-inch pipe in Church street, from Fulton to Canal street. This pipe is connected with 20-inch in Pearl street, and the one in East Broadway with 16-inch in Pearl street, 12-inch in William street, 30-inch in Broadway, 12-inch in Canal, Hudson, and Greenwich streets, and with 16 inch on Fulton street, and has furnished the supply, by 12-inch connections, for the several large double nozzle hydrants on each street between Fulton and Canal streets, on each side, about 100 feet from Church street.

In 1874 has been completed a new main from new receiving reservoir to Tenth avenue, thence to Thirty eighth street, with 12-inch connections at Seventy-seventh, Seventy-fifth, Seventy-first, Seventieth, Sixty-third and Forty-eighth streets, and 20-inch connections at Fifty-seventh and Thirty-eighth streets, and this Department is now laying this main through Forty-second street, from Tenth avenue to Fifth avenue, to connect with the mains on the several avenues—Ninth, Eighth, Seventh, Broadway, Sixth and Fifth avenues—and with the 48-inch main on Forty-second street, and with the distributing reservoir at Forty-sec nd street. We are also receiving pipes, etc., for a 20-inch main, to be laid on Fifth avenue, from Washington square to Fifty-ninth street, connecting with all the small and large mains on each street.

The Department, as soon as the Legislature furnishes the means, will lay an additional 48-inch main from new receiving reservoir to First avenue and thence to Fourteenth street, to be connected with the several cross-town mains, and a 36 inch main from Forty-second street and Sixth avenue, Thompson st., and West Broadway to Chambers street.

The Ellis Bisulphide of Carbon Engine.

We understand that, at the Atlantic Works in Boston, an experimental tugboat is in process of construction, which is to be propelled by an Ellis Bisulphide of Carbon Engine, of from 150 to 175 horse-power.

The principle upon which this engine operates is, as our readers are informed, that of utilizing the heat contained in the exhaust steam to generate the vapor of a liquid which boils at a much lower temperature than water, bisulphide of carbon being the liquid employed in the Ellis engine.

There is no question whatever as to the economy of this combination. The power obtainable from the exhaust steam by the use of the bisulphide is, when steam is cut off at one-eighth stroke in the first cylinder, and expanded down to atmospheric pressure, sixty per cent. more than that obtained in the first cylinder. Three of these engines are now running, one of which has been in operation fifteen months. No difficulties have been experienced, no repairs have been necessary. This is convincing evidence that the practical difficulties heretofore met with in endeavoring to utilize the heat in exhaust steam, through the employment of liquids which boil at a lower temperature than water, have been practically overcome. Undoubtedly modern improvements have greatly conduced to this result. For instance, Mr. Ellis informs us that only through the use of Dudgeon's tube expander has he been enabled to construct boilers sufficiently tight to retain without leakage the bisulphide of carbon vapor.

Every day that these engines run gives additional evidence of their practical value.

Of course, the more conservative among engineers will be slow to accept these improvements, yet some of the most hard headed, among whom we rank Mr. F. W. Bacon, of Boston, are becoming convinced of the utility of this system. Mr. Bacon has inspected and indicated one of these engines, and his report fully substantiates the soundness of the theory upon which the engines are constructed, and his opinions are highly favorable in regard to the general design and construction.—*Am. Artisan.*

The Pyrophone.

A novel and very remarkable musical instrument has recently been invented by M. F. Kastner, of Paris, which, it is said, produces astonishing effects even in the midst of the largest orchestras. It is termed by its inventor the pyrophone. The origin of the device is due to a curious discovery made by M. Kastner in the properties of singing flames. Many scientific men have studied these interesting phenomena, but the peculiarities of two flames in conjunction seem to have escaped their notice. As a result of his investigation, M. Kastner finds that if, in a tube of glass or other suitable material, two or more isolated flames of proper size be introduced and located at a point corresponding to one-third the length of the tube, reckoning from the base, such flames will vibrate in unison. The phenomena continues as long as the flames remain separate, but the sound ceases the instant they are brought in contact.

The pyrophone, at first sight, resembles an organ; but instead of being operated by air blown in, it produces its notes by the singing of the flames within the tubes, the quality of the sound, its pitch and intensity depending, of course, on the dimensions of the latter. The burners from which the flames emerge are so arranged that the flames run together, but may be separated instantly by pressing down a key on an

ordinary key-board in front. The position of the key in relation to the sound is the same as upon the piano or organ. According to the law above cited, as soon as a key is pressed the separated flames in the corresponding tube give forth a note, continuing, as in the organ, as long as the key is held down. It is said that the music thus produced is extremely beautiful, and that the sound closely resembles, in delicacy and purity, that of the human voice. The invention was patented in England last year (No. 1091), and is thus described in the specification:

The construction of this new or improved musical instrument, named the pyrophone, is based upon the musical instrument known as the chemical harmonicon.

It is well known that when a pure hydrogen gas-jet burns in a glass or china tube, or other vibrating material, a pleasant soft tone or sound is produced. The characteristic novelty of this improved instrument consists in the construction of the burners, and in the combined apparatus employed to act on these burners by means of the touch on the keys, similar to an ordinary piano, in order to obtain the sound or note required, or to stop it as required.

The burners are constructed with double oscillating branches or arms, in such manner that the two jets are brought into one by the contact of the two branches, whilst at the moment the sound or note is produced the two branches are separated, and form two distinct jets, which produce the vibration in the glass, china, or other tube which surrounds the branches of each jet or burner.

The improvements in the construction of the pyrophone consist—1. In dispensing with the inlet-cock for the gas. 2. In the means employed for dispensing with the two cocks heretofore employed for regulating the passage of the gas to the two branches of each tube. 3. In a more simple arrangement of mechanism for transmitting the movement of each key to its two corresponding branches.—*London Journal of Gas-Lighting.*

Street Washings for Manure.

Recent and extensive trial works, made by M. Durand-Claye, of which I am enabled now to present an account, have been made chiefly with the surface-washing of the streets, with the addition of the waste water of kitchen sinks, which is allowed to run into the gutters from some of the houses—a species of town manure of the separate productive power of which, so far as I am informed, no distinct observation of any considerable extent has hitherto been made. In streets of considerable traffic, in Paris probably as in London, the manurial deposit is greater than that derivable from within the houses. It is stated that in the city of London proper about 100 loads of mud are carted daily from the roadways before 17,000 houses. This mud, according to the analysis of Dr. Letheby, consists of about 37 per cent. of horse-dung, 17 per cent. of abraded iron, and the rest of abraded granite—a mixture which, when dispersed in dust and inhaled, might be presented as a local cause of diseases of the respiratory organs, of which 20,000 persons die annually in the metropolis.

In Paris this evil of street dirt and dust is reduced in the thoroughfares of the greatest traffic by the extensive use of impermeable asphalte pavement, which is the least adhesive to dung, and by the cleansing of the street by the jet, which sends the manurial matter into the sewers in a better condition, fresher and less decomposed, and consequently more nearly approaching in quality for agricultural use the manure from the horses. We have had distinct evidence as respects stable manure that, when applied fresh in the liquid form, it has more than double the productive power than when applied as top dressing in the solid form.

One objection made to the washing of the street surfaces by the jet is, that the detritus swept into the sewers would tend to choke them up. The answer to this objection is, that the sewers are badly constructed when this is the case, and that it will pay to reconstruct them properly for the purpose. Where the sand and granite detritus is considerable, it will be a cheaper and more convenient arrangement to make a catchpit for it at the outfall, and remove it from thence, than to gather it up along the street surfaces, or from the river bottom. There is, however, extraordinarily little detritus from hard asphalte surfaces, and the complete removal of the manure by the jet is far cheaper and more productive than the cleansing of the surfaces by the broom.—EDWIN CHADWICK in *Journal Society of Arts.*

Ingenious.

The Titusville, Pa., *Herald* says: There have been many inventions and contrivances for pumping small producing wells, and the utmost skill and ingenuity has been displayed in the application of cheap motive power to that purpose.

One of the most remarkable instances on record, however, has recently been brought to our notice, where a producer has utilized the waste water in one well to pump the oil out of another.

The well in question is owned by S. P. Logan, a gentleman of indefatigable energy and unbounded ingenuity. It is a small well, and will only yield, under the most advantageous circumstances, four to five barrels of oil per day. The cost of fuel and labor to run such a well, in the ordinary manner, would be considerably in excess of what its product would bring at present prices, and most proprietors would have "shut-er-down." Not so with Mr. Logan. He had another well about thirty rods distant on the hillside and about forty feet elevation above the flats. This well failed to yield much oil, but persistently yielded gas and water instead. A brilliant idea struck Mr. Logan. He thought that if the water rose in that hole fast enough he might syphon it out and utilize the flow to run an over-shot water wheel powerful enough to pump his well. He experimented and found the water sixteen feet beneath the surface, and after repeated trial failed to reduce the quantity, as the water rose up in the hole as fast as it could be pumped out. He then dug a trench in the hill-side, about fourteen feet deep, to the edge of the hole, which brought him within two feet of the water, and he inserted a two-inch pipe in the form of a syphon, with its long leg projecting down to his well on the flats below. After the air was exhausted, the water commenced to flow and continued to flow in a perpetual stream, the full size of the pipe. Elated with success he built a twelve-foot over-shot water wheel, with buckets one foot wide, and rigged it to the walking beam of his pumping well. When the water was turned on the top of this wheel the well commenced pumping at the rate of twenty-four barrels per day, twenty of which water and four oil. Here is a motor successfully applied, as perpetual as the hills themselves, and which is equivalent to a flowing well. The idea is most ingenious and practicable in hundreds of localities throughout this upper district, and it may yet be the means of greatly adding to the wealth of the region.—*Iron Age.*

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FRIDAY, OCTOBER 16, 1874.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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THE AMERICAN GAS-LIGHT ASSOCIATION.

This august body—august, certainly, when we contemplate the possibilities of its future—will meet within a few days of the issue of this number of the Journal (on the 21st inst.) so soon after, indeed, that very many members from a distance, would not see any remarks we might now make in anticipation of the assemblage. We shall not therefore at this time devote much space to the subject.

We cannot forbear a few words, however, which will be very few, and will be spoken out of the fulness of our respect for the great cause which this association has to uphold, the great art it has to foster, and the great trust it has to fulfil; and for which it is accountable to the future, and in a measure to the present.

This accountability and this responsibility rests more or less on every individual member of this Association, and should never be kept out of sight by any one.

Individual members may admit all this, but think at the same time that these elevated views are matters of remote realization, and of slow growth; and that it is not worth while to assume before the public, while in a mere formative stage, in childhood so to speak, the dignified attitude and conduct, in thought, word and deed, which may be thought rather to beseem a society of a more venerable age.

This do we *not* think; and though we have not authority, and cannot venture to speak in plainer words, those we have taken the liberty to use will doubtless be understood; and indeed our thoughts, we would fain believe, have been those of others, and we shall be much disappointed if the spectacle exhibited by the coming conclave of the Gas Fraternity of America be not of a character to show the stern and sterling stuff that we know is in it.

NEW-JERSEY WATER QUESTIONS: THE HOBOKEN PROJECT.

Our intention had been, in this issue, to proceed with the consideration of the main question, as to the source of supply of the great city now soon to be founded, by the union of our trans-Hudson suburbs—a city which many reasonably judge may in time be brought to rival the metropolis itself, in trade, population, industry and wealth.

Circumstances, however, have so shaped themselves that we are forced, though reluctantly, just now to defer the grand subject, in favor of one of the comparatively trivial side-issues, which is just now peremptorily forcing itself upon the public.

There exists then an important section of the New Jersey suburban districts, where, by reason of a peculiar predominating element in its population, a sectional jealousy prevails, fomented doubtless by local demagogic agencies, which, selfish and ephemeral as they are, will impress themselves, unless resisted, upon the future of this important section, and retard its comparative progress; as, in spite of natural advantages, they have already so retarded it.

The section we refer to, which has Hoboken as its largest town, is known locally as "North Hudson County." Conciseness necessitates that we but state that the "North Hudson County Water Commissioners" have submitted a scheme of water-supply based solely on the idea of making this section "independent" of the rest of mankind; which scheme we have examined into, and feel impelled here by duty to protest against, as having been imperfectly canvassed and tested, as of almost certain impurity and unhealthfulness, and as being obviously an appropriation of the product of water-sheds of which even the supreme power in their State—the legislative—has but very partial control.

In this Journal—the sole public organ in America of this eminent public concern, water-supply—we feel forced, in the interest of science and of humanity, to raise our voice, with what strength we may, when an issue of this kind is forced on a community, in the shape in which this one has been—even since the the last number of this journal.

To explain:—it is now announced that a book is opened, in Hoboken, for objectors, *for three weeks* (from Oct. 15 to Nov. 6). We shall quote to show that our information is authoritative, from a local news-column:

"Books are opened in the City Hall for objections to the proposed plan of bringing water from the Hackensack. Property owners only can vote, and must set the amount of last year's assessments opposite their names. If the assessments thus recorded equal half of the property assessed, the project falls through. Much dissatisfaction is expressed by property holders, who think the vote should be made *pro* and *con*, those in favor voting as well as those opposed. As it now stands, if a man is opposed to the scheme and neglects to vote, it counts in favor of it."

It is our function, our prerogative and our duty to speak, in this matter for the whole public, for those with and those without property, for the present and for the future. We therefore submit that this plan certainly cannot be considered as just. The rich minority have no right, arising out of their property, to govern, in sanitary matters, the large majority who own none. The dictates of justice and of reason lead to precisely the opposite conclusion. The rich can flee from unwholesome surroundings; the poor cannot. The principle involved in the above tends backward to the feudal times, when the owners of the soil owned the people, and controlled their bodies and their lives. Every man, in this age, should have an equal voice in what concerns the general health. This is, we believe, one of those rights which will always, in the end, dominate over the right of property, and, in all successful and permanent systems of civilization, must be one of the conditions on which property is held, and one which will indeed be found by property to be always, on the whole, for its own interest; being founded in justice and humanity, not to speak of christianity.

In this special case, it may be that the apprehension is that if the whole public voted, the "independent" scheme would go through without fail. Thankful are we, that we are not behind the scenes of Hoboken local politics. In any case, our duty is now done, in announcing the moral and social principle which we believe should apply in these cases. Let us now pass on to scientific considerations, where we are more at home.

In this issue is presented a document of importance belonging to the record of the subject; being a chemical report on the water of the Hackensack, to this North Hudson County Water Board, by Prof. A. K. Eaton. Upon this document, we regret to say, our critical comments cannot be altogether such as *personal* feelings would prompt. It may be said that it was through no fault of the analyst that his samples were not of his own collection, and, in fact, without re-

cord of precise place, season, or date; but this in no way remedies the lack of full scientific value thus impressed upon the figures. Nor does it appear that the author of this report had made any examination, in the field, of the Hackensack or its affluents; and a fixed principle at this day, which we could not dream of surrendering in any case so important as that of a water-supply investigation, is that the analyst should both inspect the source and collect, seal up, guard, and be personally responsible for, the samples he analyzes. We are unluckily, however, in this case forced to go further and say, that even if this be waived, and it should appear, as may yet possibly be the case, that the samples had a thoroughly responsible and reliable record—still we cannot, on critical examination of Prof. Eaton's figures, made in the light of some knowledge derived from personal inspection of the Hackensack water-shed, concur in his conclusions therefrom.

The Hackensack basin lies along the western side of the Palisades, and is chiefly very low ground, elevated but a few feet above tide-water. Now, we have supposed it a settled principle that the purity of atmospheric condensations, that is fog, dew, and even rain, and their freedom from germs of putrefaction and disease—according to both science and common sense—were proportional to the *elevation* of the portion of atmosphere from which they condense. It will not do to go back to the notions of the last generation, and say that the open air of Heaven purifies everything. We know better now; and are assured that the open air is quite as often a medium of convection of disease and death, and that its dust and floating corpuscles, which it imparts to the waters that condense in its bosom–especially at night–are quite as often, and especially near the sea-level, laden with rottenness and poison. In the present state of science, we surely should feel a grave responsibility, in recommending a water-supply, to be adopted for all time, which flows from a low-lying basin like that of the Hackensack, so long as there exists the alternative—that in this case does exist—of a large number of other water-courses, but little more distant, among the rocky Highlands of New Jersey.

Now to a brief examination of *one* of Professor Eaton's figure. More we have not space for, but this one is doubtless the most important. We refer to that he gives for *albumenoid ammonia*, namely, ·0186 per U. S. gallon. Regarding this, the analyst concludes:

"—It is considered that the amount of "albumenoid ammonia" should not exceed ·046 grain per gallon. The water in question (he here speaks of the Passaic) is within the limits of safety, but relatively to the other (the Hackensack) is greatly inferior."

It is presumable—in fact, seems undeniable, that the figure ·046 here referred to is derived from the Manual on Water Analysis of Wanklyn & Chapman, page 62, where they say:

"All drinking waters may reasonably be required to be of such a degree of purity as not to yield more than 0·08 mm. of albumenoid ammonia per litre." This is equivalent to about ·0046 per U. S. gallon, by our count; or to but 1-10th of Prof. Eaton's figures. We can but conclude that the Hackensack water analyst has made a little mistake in arithmetic; and estimated and stated the amount of this most significant contamination considered "within the limits of safety" as ten times too great! Hence, we cannot but take the ground, that, in spite of this Report, we are as yet without analytical evidence of the exceptional degree of freedom from putrefiable matter in the water of the Hackensack, which has been erroneously believed, by those who have read unquestioningly the said Report.

It happens that in looking back through past records of the history of water-supply questions in New Jersey, we have lighted on a passage in the very first report on the subject, dated Dec. 8, 1851, signed by Messrs. Ward, Gregory, Van Boskerck and Coles, showing that these gentlemen had examined the Hackensack scheme, and there state that "the quality of the water in that part of the river at present beyond the reach of the tide is reputed to be indifferent, being strongly tinctured with decaying vegetable matter."

But one point remains to us at present, of importance to crowd out other matter. Has it not been overlooked by these gentlemen—the North Hudson Water Commissioners—that but a small fraction of the water-shed they propose to appropriate is in their state at all, and that the Northern portion—from 70 to 80 per cent. (leaving out Closter Brook)—is New York State water; which such growing towns as Nyack and Piermont, will soon need and take possession of; with no power in New Jersey to say them nay.

We should think there is certainly here matter enough to induce those of the North Hudson County property-holders who may chance to encounter this article, to remember, some time within the ensuing three weeks, the "book for objections" and not permit this objectionable and enormously expensive scheme to be saddled them through default.

In any case, we have said our say, and we have done our duty, on *this* branch of the subject; and trust that we here take leave thereof.

EDITORIAL NOTICE.

If what we hear is correct, and we have no reason to doubt it, a very important new invention is now being announced in our advertising columns. James Slade, Esq., Superintendent of the Yonkers Gas-Light Company, claims that the greatest drawback to the more general introduction of the Exhauster into small gas works, is the expense of running them. But this seems now to be overcome, as by the use of Slade's Automatic Fire Governor all the expense or attention is reduced to merely keeping the fire under the boiler.

We certainly urge all gas engineers who pass that way to call at Yonkers and see Mr. Slade's device at work.

Prof. Henry Wurtz,

Chemist and Geologist.

Editor of the AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY; the only acknowledged and accredited organ of the GAS MANUFACTURING Interest and of WATER SUPPLY, on the American Continent.

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The Spectroscope and Bessemer Steel.

A. McMartin stated to the American Institute of Mining Engineers that the use of the spectroscope in the Zwickau process is one of the most beautiful expedients in metallurgy. One never tires watching the brilliant changes in the spectrum, blow after blow. The specific causes of these changes have been the subject of much dispute and unsatisfactory investigation. But all are agreed that carbon has something to do with them, whether as such, or in gaseous form in such nitrogenous compounds as cyanogen. Whatever be their cause, these changes take place—and that so regularly, than an experienced eye can place full dependence upon them as indicators of the state of preparation of the metal bath. The spectrum at first appears without lines; but as soon as the spark period begins to give place to its successor, and the clear flame to extend out of the mouth of the converter, the bright orange-yellow sodium line quickly makes its appearance, and remains clearly visible till the blast is turned off. After the sodium line, appear the red lines, which represent calcium and lithium; and then a beautiful series of perfectly graded green lines in the green, and pale blue lines in the blue section of the spectrum, manifest themselves, one after another, each in its series, until, at the climax of the operation, when the greatest heat is attained, the spectrum rivals that of chloride of copper in beauty and brilliancy. A very experienced eye can also sometimes see a beautiful violet line in the violet section at this point.

But the characteristic lines of the Bessemer spectrum are the beautiful band-like, graduated series, in the blue, and especially in the green, section. In the inverse order to that in which they arose to their climax, these lines gradually diminish in brilliancy, and at last vanish. But some of the green lines still remain, after the blue series has entirely vanished; and at this point nothing must be allowed to distract the conductor of the operation from closely watching the spectrum; for the only index (though a perfect one) of the exact end of the operation, is the degree of brilliancy of certain green lines, which remain when the charge has arrived at the point of desired decarburisation. For different mixtures of pig-iron, a slight difference in the appearance of the indicating green lines is noticeable at this point; and, to secure, with the same mixture, a desired slight difference in the grade of steel produced in two different blows, proper allowance must be made, on one or the other side, of a certain degree of brilliancy of the green lines.

A Bogus Gas Bill Collector.—The *Brooklyn Union* of September 24 gives the following item: A man has been in the habit of calling at the residences of gas consumers in this city and representing himself to be a collector for the gas company, with bills bills made out, which he receipts if paid. In some cases the bill is much smaller than the one formerly presented by the company, and persons naturally thinking that they have a soft thing of it pay the bill without grumbling. But they find out their mistake when the authorized agent of the company calls and demands payment of his bill. It has been discovered that considerable money has been collected by this party.

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Liverpool caking	11 50	@	12 00
British Province Coals.			
Pictou			2 50
Block House—At Mines, $2 12, Gold			0 00
Caledonia—At Mines, $2 00, Gold			0 00
Little Glace Bay—At Mines, 1 87½, Gold			2 00
Lingan—At Mines, $2 25, Gold			0 00
Sydney—Old Mine			3 00
" Reserve Mine			2 25
" International			— —
(Duty, 15 cents per ton, gold. Freight to New York $2 25, currency. Cost of above coals delivered in New York, $5 25 @ $6 00½, currency.)			
Pennsylvania Coals.			
Penn Gas Coal—At Amboy	$7 00	@	0 00
Westmoreland—At Amboy	7 00	@	0 00
(In New York both the above coals $7 50)			
Shafton	7 50	@	0 00
Youghiogheny	7 75	@	0 00
West Virginia Coals.			
Murphy Run	$7 40	@	0 00
Despard	7 40	@	0 00
West Fairmont	7 40	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	7 40	@	0 00
Newburgh Orrel	7 40	@	0 00
Pinnickinick	7 40	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —
American Cannel Coals.			
Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			12 50
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The Waverly Coal and Coke Company of Pittsburgh, have contracted with the Pittsburgh Gas-Light Co. for 40,000 tons of their Youghiogheny coal, on private terms.

P.P. DEILY, 1842. J. FOWLER, 1874.

DEILY & FOWLER,

39 LAUREL STREET, PHILADELPHIA, PA.,

Builders of Gas Works.

MANUFACTURERS OF

GAS-HOLDERS,

Single and Telescopic.

WROUGHT IRON ROOF FRAMES,
COAL WAGONS,
COKE BARROWS,
AND ALL
Wrought Iron Work
CONNECTED WITH GAS WORKS.

☞ Particular attention paid to Extensions and Repairs.

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MANUFACTURERS OF AND DEALERS IN

EVERY DESCRIPTION OF

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25, 27 and 29 North 20th Street, Phil'a.
353-1y CHARLES H. BROWN, Manager.

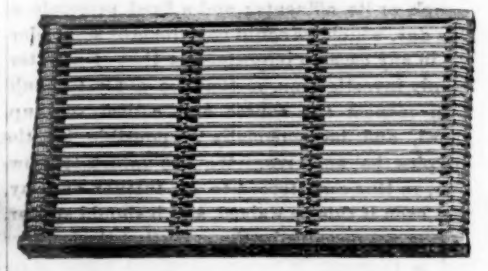
SLADE'S
AUTOMATIC FIRE GOVERNOR.

PATENTED AUGUST 4, 1874.

It regulates the speed of Exhausters by controlling the fire. The least pressure on the Retorts opens the Damper in the Boiler Chimney and under the fire, and closes them as soon as the pressure is removed. Saves the boiler, fuel, and all attention, except to supply the fire. Come and see it, or address

JAMES SLADE,
Gas Works, Yonkers, N. Y.

THE MANHATTAN
LIME HURDLES.



The most satisfactory results ever produced by any device used for supporting slaked lime, for the purpose of purifying coal gas.

6,800 CU. FT. OF GAS PURIFIED PER BUSHEL OF LIME.

These Hurdles combine, as no other device has, *Extreme Porosity*, with Lightness, strength, and durability.

Their *entire cost will be saved* in one seasons use, in preventing carbon accumulations in the retorts, and in allowing the *entire* body of lime to be of service.

Gas Light Companies before ordering elsewhere will find it for their interests to give these Lime Hurdles, or supports, their consideration, and a trial will substantiate the above.

We shall deliver for six months, these Lime Hurdles, or supports, to most any point in the United States, free of Freight charges.

THE MANHATTAN
LIME HURDLE CO.

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GLOUCESTER CITY, NEW JERSEY.

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CAST IRON GAS AND WATER PIPE

PIPE CAST VERTICAL.

1½ to 48 inches diameter.

Cast Iron Flange Heating and Steam Pipe.

STOP VALVES FOR WATER OR GAS, ALL SIZES.

Fire Hydrants,
GAS HOLDERS,
TELESCOPIC OR SINGLE.

☞ Castings and Wrought Iron Work of all kinds for Gas Works 253-6m

KIDD'S
Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

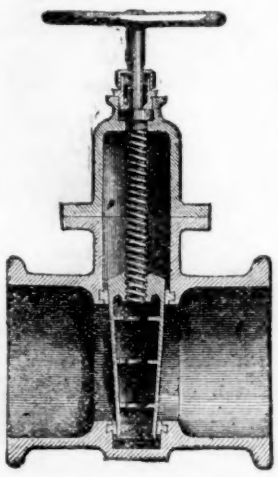
A. M. CALLENDER & CO.,
42 Pine Street, New York, Room 18,

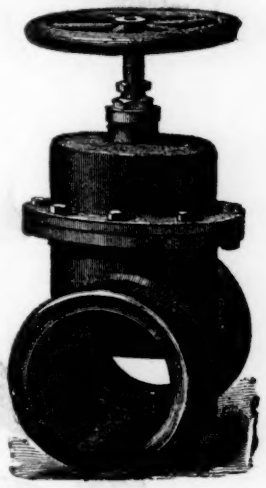
CHAPMAN VALVE COMPANY.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.





These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is NO LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHE and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.
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CANNELTON COAL COMPANY

Of West Virginia,

Offer to Manufacturers of Gas the pure Cannel Coal from their Colliery at Cannelton, West Virginia. This coal after having been thoroughly tried by the most expert and reliable Engineers, has shown itself to be the most valuable **Enriching agent** produced in this country—a gross ton yielding **10,000** cubic feet of gas, of **61.54** candle power, to purify which, required only two bushels of lime. The yield of coke is **32 bushels** of good quality, quite light, burns freely, making a very hot fire. For further information address

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P. O. Box 1747. No. 325 Chestnut Street, Phil'a.

PEYTONA CANNEL COAL

From West Virginia.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

S. E. LOW, Secretary,
254 Office, 28 Broadway.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Entrance Examinations June 1 and 2, and Sept 23 and 24. For new Catalogue and late Entrance Examination Papers apply to PROF. SAMUEL KNEELAND,
255-121 Secretary, Boston, Mass.

PROVIDENCE Steam & Gas Pipe Co.,

PROVIDENCE, R. I.,

BUILDERS OF

GAS WORKS

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GAS-HOLDERS,

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PURIFIER COVERS,
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Particular attention given to

Enlarging and Rebuilding Gas Works.

PRINCIPAL OFFICE AND MANUFACTORY CORNER PINE AND EDDY STREETS. PROVIDENCE, R. I.

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RILEY A. BRICK & CO.,

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,

ALSO,

GAS WORKS AND MACHINERY CASTINGS

OF EVERY DESCRIPTION,

No. 112 Leonard Street, New York.

RILEY A. BRICK. JAS L. ROBERTSON

AMERICAN GAS WORKS CONSTRUCTION AND *Supply Company.*

President—JAMES A. TAYLOR, Columbian Iro Works.

Engineer—A. F. HAVENS, late of Brooklyn Ga Light Co, Patentee of the following inventions:

HOISTING ENGINES,
COAL ELEVATORS,
WIRE-ROPE RAILROAD,
TRAYS FOR LIME OR IRON
RETORT CHARGING AND RAKING MACHINE,
RETORT SETTINGS,
SELF-SEALING LIDS,
AUTOMATIC DIP-PIPE SEAL
SECTIONAL PURIFIERS.

The above Patents are the result of many years experien and are of great value, enabling any Company to incr the capacity of its Retort and Purifying Apparatus 15 to per cent without change, and at slight cost.

Plans, Specifications, and Details furnished of all Appar tus, and Companies supplied with every thing required in Gas Manufactura, from the greatest to the least, at the lo est market rates.

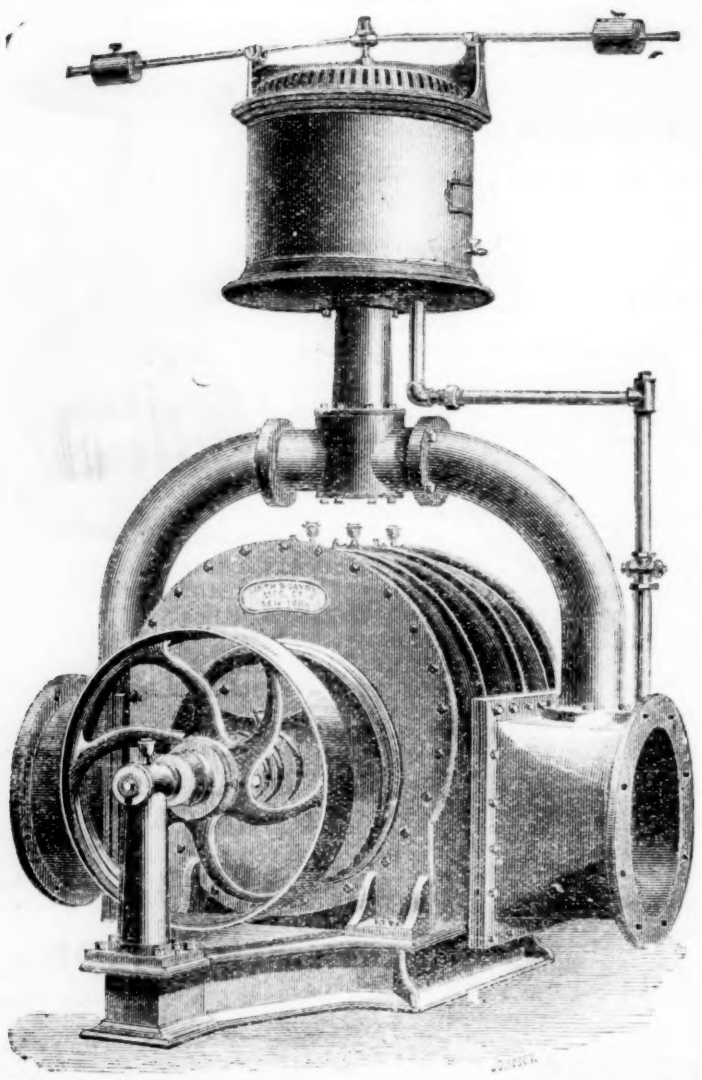
American Gas Works Construction and Supply Company,
No. 34 Dey St., N. Y.

☞ Mr. HAVENS can be consulted on all matters apperta ng to Gas and its manufacture, gratis.

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan.

The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola, and 33 per cent fuel. Address

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JAMES M. SAYRE, Treasurer. OFFICE, 96 LIBERTY STREET, New York.
CHARLES W. ISBELL, Secretary.

AMERICAN

GAS SCREEN MAN'F'G COMPANY.

TO GAS-LIGHT COMPANIES.

Your attention is respectfully called to the GAS SCREEN now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other screens now in use.

The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces, the edges of the frame being grooved to prevent abrasion.

The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4th. Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFEE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of* pen space in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than wh the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yours,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3, 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.'
SPRINGFIELD, MASS., Oct. 10, 1871.

MR. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent, more gas with them than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give you my experience.

Yours truly,
P. E. DEMILL, Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co., Boston, Mass. Gas-Light Co.; East Boston, Mass., Gas-Light Co.; South Boston, Mass. Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.; New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas-Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.; San Francisco, Cal., Gas-Light Co.; Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **R. A. POTTER, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass.
EDWARD DUFFEE, Agent.

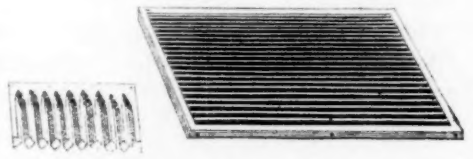
J. L. CHEESMAN.

MANUFACTURER OF

Patent Conically and Diamond Slotted

SOLID WOOD TRAYS.

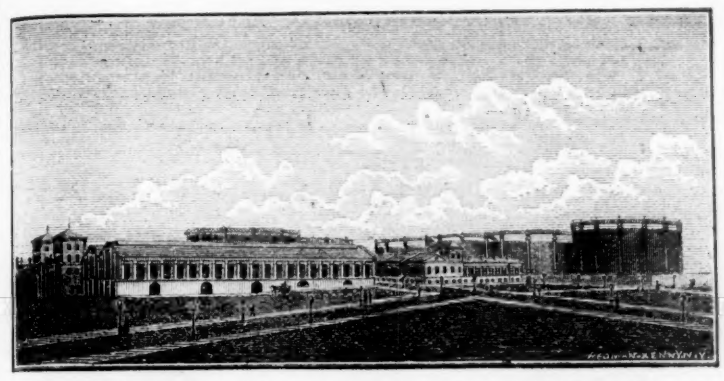
PATENTED OCTOBER 21, 1862 AND JUNE 10, 1873.



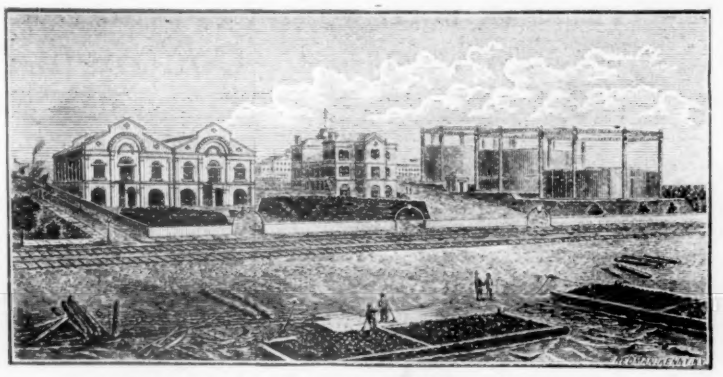
To Gas Companies.

The above Trays will last longer, and are cheaper than any Tray now used. They are now made without any outside strips, which gives more purifying surface, being perfectly smooth. The lime will not adhere to them as in other Trays They are now used in over three hundred Gas Companies the United States, and other places.

JOHN L. CHEESMAN,
151 and 153 Avenue C, New York.



CINCINNATI GAS WORKS, ERECTED 1871-72-73.—WM. FARMER, ENG.



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG.

WILLIAM FARMER.

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

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GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL, N. Y.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [342

GAS PURIFICATION.

St. John and Cartwright's
NEW IRON COMPOSITION

Has purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime*. Takes out *all the ammonia*. Now operating in the following Gas Works: Harlem, New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct.; and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500; $250 additional for each additional 50,000 per day.

For further information and instructions, apply to
ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for the prepared composition is increasing *so rapidly* that delays in supply may occur.

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

Office & Factory 52 East Monument St.,
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Having added a
SCOTT'S
GEAR MOULDING
MACHINE
To our Foundry, we are now prepared to furnish,
WITHOUT CHARGE FOR PATTERNS,
GEAR-WHEELS
OF ALL DESCRIPTIONS,
AT THE
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Work warranted perfectly accurate. Send for circular giving price, and directions for ordering.
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NEW YORK STEAM ENGINE CO. MANUFACTURERS OF MACHINISTS TOOLS OF EVERY DESCRIPTION 98 CHAMBERS ST. N.Y.

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MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS,

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

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Indianapolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co
Topeka, Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
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Camden Iron Works

Camden, New Jersey.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 226-tf

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B. E. CHOLLAR,

Gas Engineer,

914 OLIVE STREET, ST. LOUIS, MO.

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FREEMAN BUTTS,

Of Cleveland, Ohio.

AND SHIPPER OF THE CELEBRATED AND ONLY GENUINE

Sterling Coal,

also dealer in YOUGHIOGHENY, PITTSBURGH, AND AMERICAN CANNEL. Would refer to the following Gas-Light Companies, who have used the HAND PICKED SELECTED COAL:

New York City, Manhattan and New York Companies, Brooklyn, Albany, Troy, West Troy, Rochester, Buffalo, Oswego, Ogdensburgh, Lansingburg, Newburg, Rome, Palmyra, Geneva, Yonkers, Rondout, Kingston, Albion, Brockport, Seneca Falls, Elmira and Lyons, in State of New York; Cleveland, Toledo, Sandusky, Norwalk, Oberlin, Salem and Fremont in Ohio; Detroit, Ann Arbor, Grand Rapids, Kalamazoo, Jackson and Adrian, in Michigan; Toronto, Hamilton, and Coburg, in Canada; Chicago, Ill., and two Companies in Milwaukee, Wisconsin.

Letters in reference to Coal should be addressed to the General Office of FREEMAN BUTTS, Cleveland, Ohio. 354

MONONGAHELA GAS COAL COMP'Y

Of West Virginia.

OFFICE, 56 EXCHANGE PLACE.
(P. O. Box 432.)
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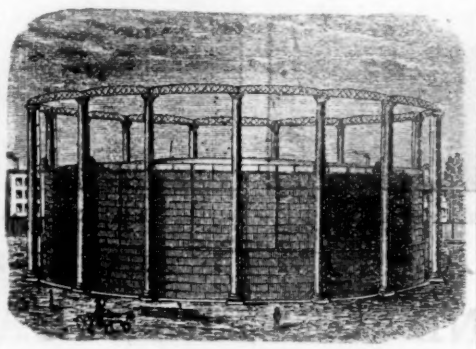

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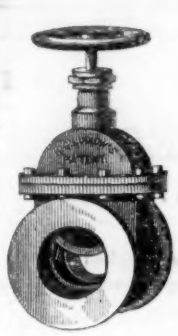

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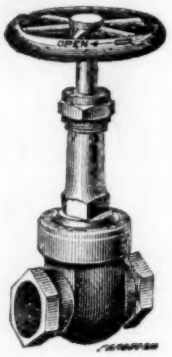

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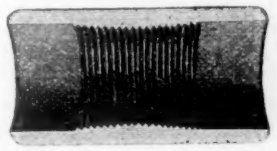

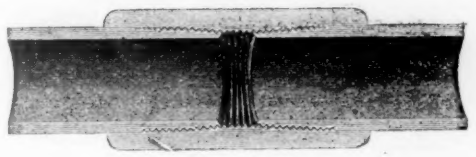

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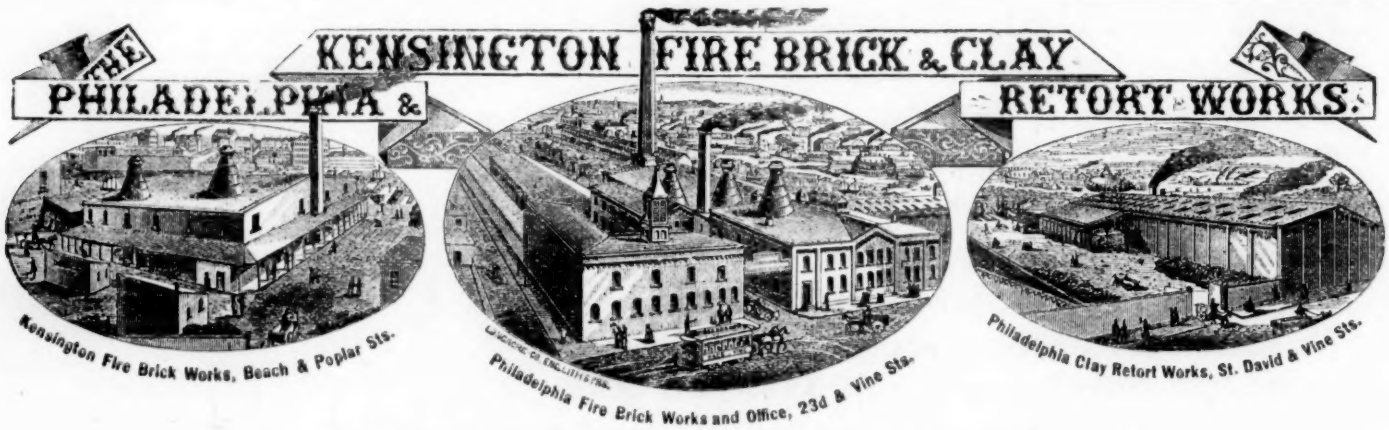
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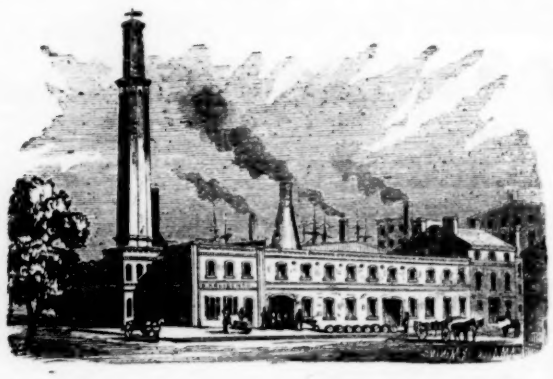

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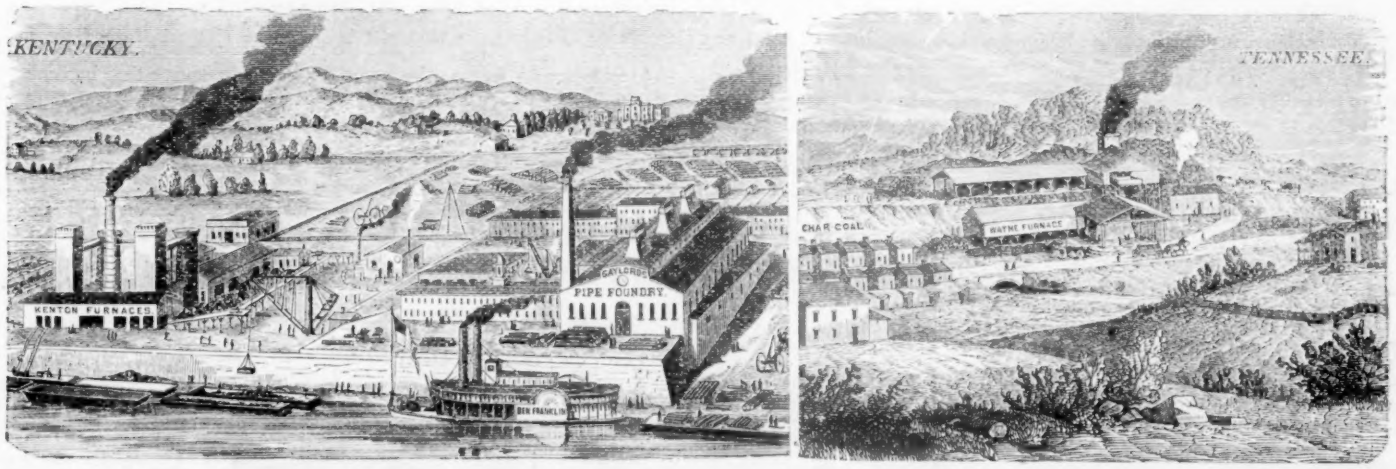

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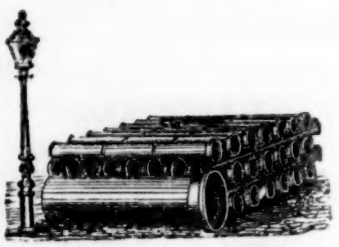

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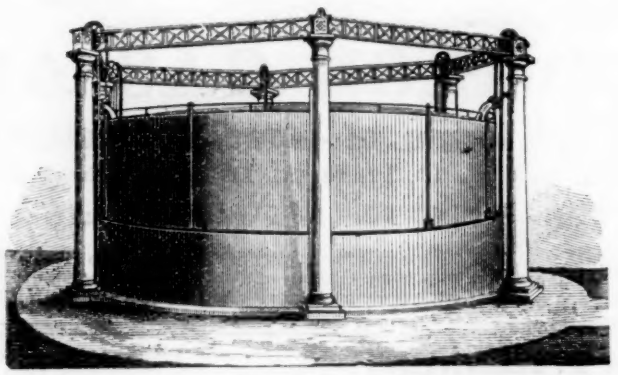

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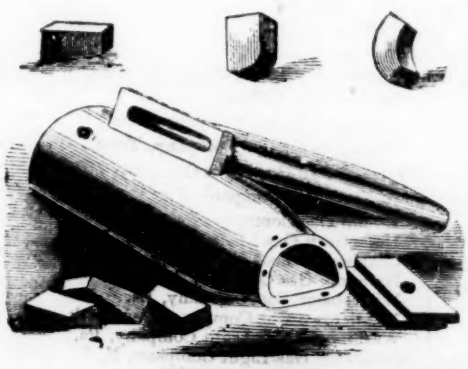

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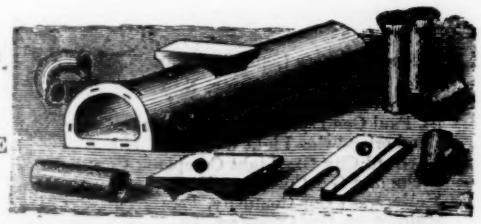

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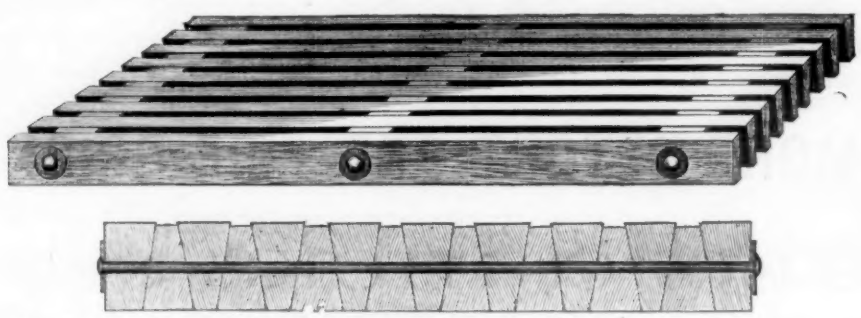

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